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Mathematical Physics

Some uniqueness results for stationary solutions to the Maxwell-Born-Infeld field equations and their physical consequences

Michael K.-H. Kiessling

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Uniqueness results are established for time-independent finite-energy electromagnetic fields which solve the nonlinear Maxwell--Born--Infeld equations in boundary-free space under the condition that either the charge or current density vanishes. In addition, it is also shown that the simpler Maxwell--Born equations admit at most a unique stationary finite-energy electromagnetic field solution, without the above condition. In these theories of electromagnetism, the following physical consequences emerge: source-free field solitons moving at speeds less than the vacuum speed of light c do not exits; any purely electrostatic (resp. magnetostatic) field is the unique stationary electromagnetic field for the same current-density-free (resp. charge-density-free) sources. Our results put to rest some interesting speculations in the recent physics literature.

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